

# Village Pilot Projects in Chile

by E. Ian Baring-Gould 12/99

## Scope

In October 1994, the U.S. Department of Energy (DOE) and the National Energy Commission of Chile (CNE) signed the Technical Cooperation Agreement for the implementation of renewable energy rural electrification projects, which will be developed within the framework of the Chilean Rural Electrification Program (PER). PER's goal is to have 100% electrification throughout the country by 2005. To reach this goal, Fondo Nacional de Desarrollo Regional (FNDR) will provide funding at the national level, regional authorities from Secretaria Regional Ministerial de Planificación Coordinación (SERPLAC) will select the projects, and private enterprises will implement them.

According to PER, stand-alone alternatives based on renewable energy sources and village-wide mini-grids are an important part of the solution. In 1994, the Inter-American Development Bank (IDB) announced that FNDR funds, which previously had only been available to finance grid extension projects, were now available for renewable energy sources. Whereas Regions I through IV in northern Chile will focus on photovoltaic (PV) systems, Regions VI through XII will focus on hydro and wind-hybrid systems.

In December 1995, the Region IX SERPLAC and a private electricity distribution company, SAESA/ Frontel, signed an agreement to implement hybrid wind energy projects in Region IX as a demonstration of these technologies. The agreement stated that the projects would be funded as follows: FNDR subsidy (US\$71,605), U.S. contribution (US\$100,000), villagers (US\$5,852), and Frontel (US\$13,580). These funds were used for three pilot projects in Region IX. In 1998, additional funds were made available, including approximately \$60,000 from the United States and \$110,000 from the Region X government, for two more pilot projects.

## Activity Summary and Status (1999)

**Region IX**—Work on pilot projects in Region IX began in January 1996 with the identification of potential sites by the Region IX SERPLAC, Frontel, the National Renewable Energy Laboratory (NREL),

and the National Rural Electric Cooperative Association (NRECA). Three sites were identified. One of the sites is Puaicho, a small community on a hill overlooking the Pacific Ocean with three residences, a school, and a health post. A 2.0 kilowatt (kW) system using the Bergey Windpower Company, Inc. (BWC), 1.5kW wind turbine was installed at this site. The second site, Isla Nahuel Huapi (INH), is a tiny island in Lago Budi near the Pacific coast with 11 residences and a health post. A 4.5kW system using a World Power Technology Whisper 3.0 turbine was selected for INH. The third site, Villa Las Araucarias (VLA), is a larger village located in the highlands approximately 30 km from the Pacific coast. A 4.5kW system using a BWC Excel wind turbine was selected for VLA, and it was designed to include expected growth in the community. Presently, 10 of the 17 residents, the school, health post, and streetlights are connected to the system.

The planning and design of all three systems started in January 1996, with construction beginning in June. All three systems were commissioned in January 1997 with NREL, NRECA, and Frontel taking part in every stage of the project implementation. In addition, data acquisition systems were installed to monitor system performance. At that time, the NREL/NRECA team trained Frontel personnel on the systems' operations and maintenance procedures. One representative from each village was also trained to perform basic system diagnostics and maintenance. Several additional training workshops then took place after the systems were installed.

Each system continues to provide power to the community; however, design and institutional problems have produced mixed results in system operation. Key factors include changes in personnel providing oversight to the project, inadequate maintenance attention, and little follow-up after specific problems have been identified. The critical missing element has been consistent support of the project from utility management. One reason for the minimal support is that the tariff charged to the consumers is similar to the one used in the urban areas; thus, the systems' main-

tenance is not self-supporting. Currently, the system at VLA is providing power approximately 14 hours per day, supported primarily by the backup generator. This is a result of marginal wind resource, approximately 3.5 m/s during the last two years, and inadequate maintenance of the system's operation. The Puaicho system was decommissioned in the fall of 1999 when the community was connected to a long-planned grid electrification project. The Puaicho power system was in full-time operation when disconnected and will be moved to a new community. The system at INH is also operating within its design specifications.

**Region X**—Two pilot projects are under development in this region of Chile. The first site, scheduled for installation in March 2000, is on the island of Tac in the Chiloe Sound, south of the regional capital of Puerto Montt. This system will electrify all of the island's 85 homes using two BWC Excel turbines and parallel Trace Engineering inverters with a rated output of 9 kW. The second site is Bahia San Pedro. This village is located in the northwestern corner of the region along the coast and is quite isolated. It has 16 homes, a school, and a health post. A planned installation date for a 4.5kW system in Bahia San Pedro is to be set.

To nurture the renewable energy industry in southern Chile, the NREL/NRECA team has limited its role in the design and installation of the two Region X systems. A Chilean company, Wireless Energy Ltd of Puerto Montt, is supplying and installing both systems. Even though NREL remains active in the projects, the work is concentrated among Wireless Energy, the Chilean utility SAESA/Frontel, and the regional government.

Analysis is under way to implement 35 systems on more islands in the Chiloe Sound. Regional and federal governments will solely fund the Chiloe Islands project and award it in the same fashion used for large grid extension projects. NREL/NRECA is assisting the government in economic analysis and conceptual technical design, which will lead to a competitive request for proposals (RFP) document.

**Region XII**—NREL is currently working with faculty at the Universidad de Magallanes in Punta Arenas on rural electrification projects for schools and remote ranches. Recently, a system comprised of two BWC 1.5-kW turbines was installed in Aqua Fresca, a small boarding school 30 km south of the regional capital. This system supplements an existing diesel generator that provides electric power for only a few hours each day. Although the university is taking the lead

on this project, NREL is supplying technical assistance and a data acquisition system to monitor system performance. The university and NREL are also looking at other applications for renewable energy technology, such as providing clean power to facilities in local national parks and water pumping to support cattle grazing.

## **Planned Activities (1999–2000)**

Activities during the coming year include: (1) installing pilot systems at Isla Tac and Bahia San Pedro, (2) monitoring the performance of all six pilot projects, (3) supporting the re-installation of the Puaicho power system, (4) working on improvements for system operation at the three Region IX projects, and (5) completing the RFP document for the Chiloe Islands project.

## **Results to Date**

The fact that the Chilean government will fund the complete cost of the Chiloe Islands project indicates that wind-hybrid technology is a solution for remote rural electrification problems in southern Chile. Another indication is that companies specializing in the use of renewable energy technologies are active in this region, which is one of the primary goals of NREL's pilot projects. However, the difficulties experienced at the Region IX projects demonstrate that the key issue in the development of sustainable solutions is institutional in nature.

## **Team/Partners**

The U.S. team consists of NRECA (South America), the American Wind Energy Association (AWEA), and NREL.

## **Sponsoring Agencies**

These projects are jointly funded by DOE, the government of Chile (CNE), and the U.S. Environmental Protection Agency. The IDB supports the Chilean FNDR funds.

## **NREL Contact**

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